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First report of infection with the Tapeworm Ligula intestinalis (Linnaeus, 1758) plerocercoids in Persian bleak, Alburnus hohenackeri Kessler, 1870 in Southeastern Iran

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Abstract: The *Lernaea* parasite was reported in *Alburnus hohenackeri* Kessler, 1870, collected from the Char-Nimeh (or Chahnimeh) lake, Eastern Iran. Three fishes were infected with *L. intestinalis* having 3 to 22 parasites increasing with fish size. The maximum and minimum of parasite lengths were 138.02 mm and 24.54 mm respectively. The prevalence, mean intensity and abundance of infection by plerocercoid of *L. intestinalis* were 33.33%, 13.33, and 4.44 respectively.

Keywords: *Alburnus hohenackeri*, *Ligula intestinalis*, Freshwater fish, Iran.

Introduction

The Persian bleak (the morvarid mahi, meaning pearl fish) *Alburnus hohenackeri* Kessler, 1870 was mainly distributed in western and southern Caspian basin, from Kuma to Atrek (Atrak) drainages (Zareian et al. 2013, Coad 2013). However, it has been widely translocated into many other water bodies of Iran across western, central, north eastern and eastern Iran (Fig. 1), including Choghakhor Wetland in Tigris River basin, Kardeh Dam in Harirud River basin and in the Hamun Kushk, and Kahak and Sistan dams of the Sistan basin (Esmaeili et al. 2011a, b; Zareian et al. 2013; Coad 2013). Its habitat is water bodies with slow to fast current. It prefers places where current is slowed down. This species abundant in middle and lower reaches of large rivers and their tributaries, reservoirs and swampy creeks, and also in brackish water at river mouths, in estuaries and coastal lakes (Kottelat & Freyhof 2007).

Ligula intestinalis (Linnaeus, 1758) is a cestod from family Diphyllobothriida. Tapeworm related to the family Diphyllobothriida (Pseudophyllidea) living in the intestine of fish-eating birds and reaching a length of up to 28 cm. Its plerocercoid is found mostly in cyprinid fish, measures 2–60 cm in length, and often represents 25% of the fish's body weight (Mehlhorn 2008). However, it has been reported from ship sturgeon (Acipenseridae) of the Caspian Sea (Mousavi et al. 2000) and also common tooth-carp (Cyprinodontidae) of coastal area of the Persian Gulf (Gholami et al. 2011). This cestode has a three-host life cycle (Turgut et al. 2011). The coracidium larva penetrates the gut wall of a copepod microcrustacean and develops into a procercoid. The infested copepod is ingested by a planktivorous fish and the procercoid then develops into a plerocercoid larva located in the host abdominal cavity. The definitive host is an ichthyophagous predatory bird in which the plerocercoid matures. Parasite eggs are then released into the water with bird faeces (Brown et al. 2002). It influences on fish health, inhibiting gametogenesis and behavior (Brown et al. 2002; Carter et al. 2005; Trubiroha et al. 2009) and it can cause heavy losses in freshwater pisciculture and reduce economic value of fish (Turgut et al. 2011).

The plerocercoid of this species have been recorded from the abdominal cavity of a wide range of fish hosts, particularly members of the Cyprinidae, from worldwide locations (see İnnal et al. 2007; Hajirostamloo 2008; Hoole et al. 2010;

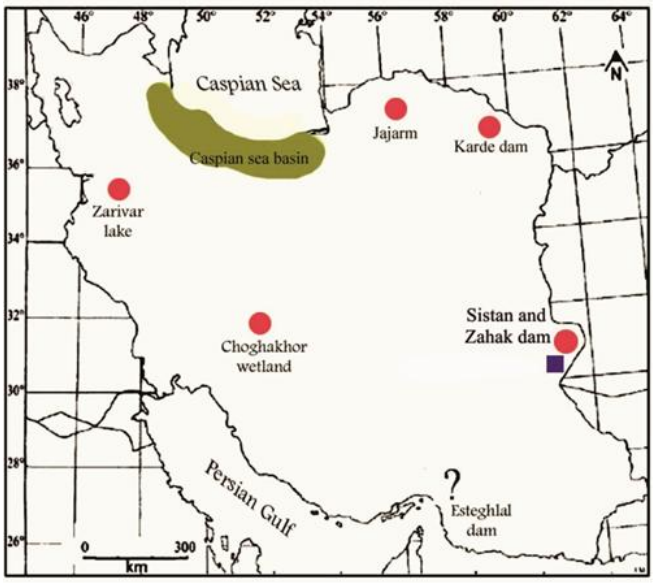

Fig.1. Distribution map of *Alburnus hohenackeri* in Iran; green shaded area: Main distribution range, red circles: translocated localities, and blue square: collected specimens in this study. (Source of Map: Zareian et al. 2013)

Koyun 2006; Turgut et al. 2011; Urdes & Hangan 2013). It also has been recorded from different fish species in different localities of Iranian freshwaters (Pazooki & Masoumian 2012). In the present study, we report the infection of this parasite in *Alburnus hohenackeri* in Sistan basin for the first time.

Material and methods

During field work in Sistan and Baluchistan province in June 2013, we captured three *Cyprinus carpio* and nine *Alburnus hohenackeri* in the Char-Nimeh (or Chahnimeh) lake (N: 30°46'49.1", E: 61°38'16.6") (Fig. 1) using cast net.

The Char-Neimeh (or Chahnimeh) Lake is a depression used as a water reservoir and is filled from the Parian branch of the Helmand. It has a surface area of 4,700 ha and is used for irrigation and fish culture but does reduce flow into the Hamuns (Coad 2013).

The collected specimens were preserved in 10% formalin and deposited in the Zoological Museum, Collection of the Biology Department of Shiraz University (ZM-CBSU). Total length (TL) and standard length (SL) of the collected specimens were measured. The fish was dissected and the body cavity and viscera were examined to determine the presence of the parasite. Total length of parasites was measured using vernier caliper (Table 1). Prevalence (%) was calculated according to the percent of infected fish divided by the total number of fish. Mean intensity was determined by dividing the total number of collected parasites to the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites to the total number of examined fish (Gholami et al. 2011).

Results and discussion

Out of nine collected specimens of *Alburnus hohenackeri*, three fishes were infected with *L. intestinalis* (Table 1, Fig. 2) having 3 to 22 parasites increasing with fish size. The maximum and minimum of parasite lengths were 138.02 mm and 24.54 mm respectively. The prevalence, mean intensity and abundance of infection by plerocercoid of *L. intestinalis* were 33.33%, 13.33, and 4.44 respectively (Table 1). Abdomen of specimens was protuberant due to the infection. The plerocercoids of *L. intestinalis* coiled around the viscera and occupied the body cavity (Fig. 2). There were no organs or viscera in the specimens and just remnants of swim bladder and gut were observed. Due to absence of reproductive organs, sex determination was not possible.

This parasite is known to be the causative agent of ligulosis disease in fish. Clear distension of the abdominal cavity of *A. hohenackeri* as the worm increases in size is probably the most visually astounding feature and this change the fish morphology. This distension can cause impairment of muscle development and also reduces streamlining which increase the risk of predation. Erratic swimming is also another effect of Ligula on infected *Alburnus* fishes. Due to pressure, *L. intestinalis* causes degeneration of the gonads and the subsequent partial or complete sterilization of

Table 1. Details of infected *A. hohenackeri* with *L. intestinalis plerocercoids* and normal specimens in Char-Nimeh, Sistan va Baluchestan Province, southeast of Iran. (T.L= total length; S.L= standard length).

Fish Museum No.	Fish T.L (mm)	Fish S.L (mm)	Max. body depth	Parasite Max. T.L (mm)	Parasite Min. T.L (mm)	Total parasites	Prevalence	Intensity
1320	59.92	51.29	12.50	84.34	51.68	3		
1322	96.58	82.61	26.28	111.38	24.54	22		
1323	83.30	72.50	23.26	138.02	50.12	15		
1315	101.21	84.01	16.59	-	-	-		
1316	81.64	68.12	13.72	-	-	-	33.33%,	13.33
1317	78.65	65.23	13.80	-	-	-		
1318	79.76	69.79	14.40	-	-	-		
1319	77.69	64.08	12.71	-	-	-		
1321	71.63	62.52	12.93	-	-	-		

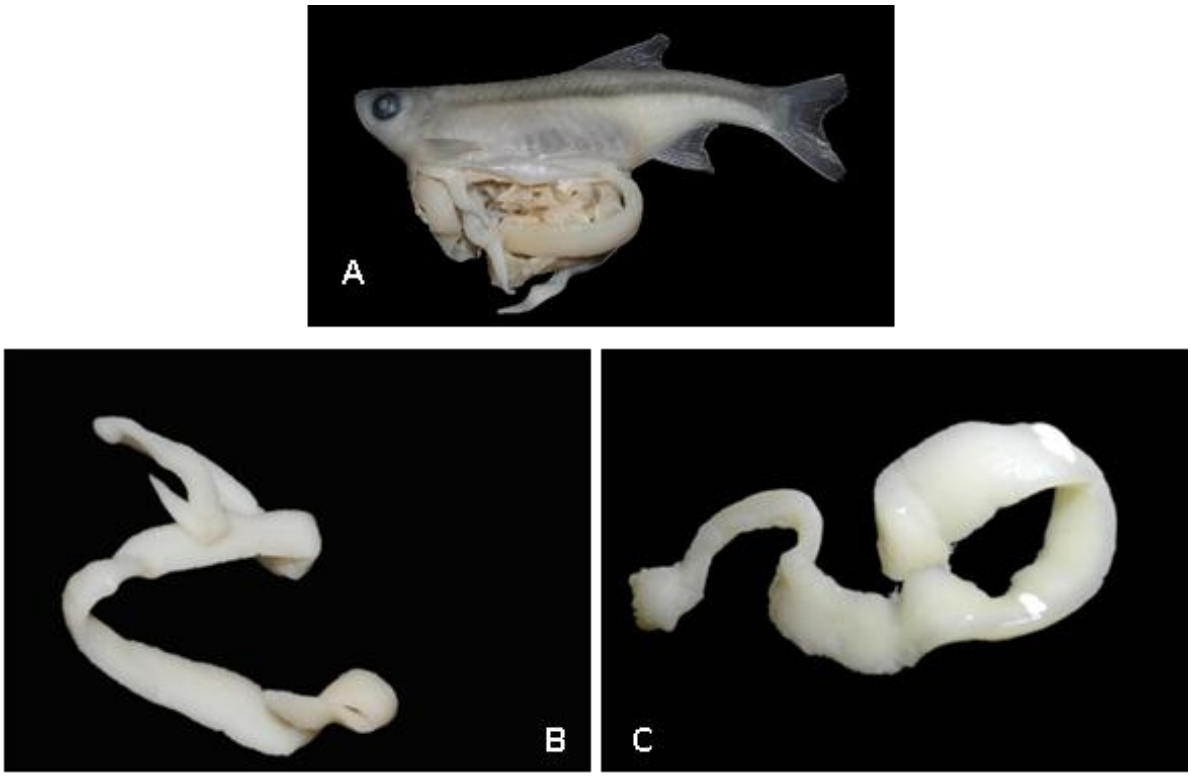

Fig.1. Photographs of infected *A. hohenackeri* (A) and the parasite, *L. intestinalis* (B, C)

fish. According to Arme & Pappas (1983) and Azadikhah et al. (2013), growth reduction, anemia and blood parameter changes, dark coloration and fish mortality are the other effects of Ligula on the infected fish.

Ligula infection can spread very quickly over a large area via infected birds, drastically affecting fish populations (Hoole 1994). Also it is thought to be the most important tapeworm of cyprinids and can be a major threat to natural and farmed fish populations. Thus, we suggest an epidemiological survey in this region for screening the intensity of infection in other fish species especially native fishes including *Schizothorax zarudnyi* (Nikol'skii, 1897); *Schizopygopsis stoliczkai* Steindachner, 1866; *Schizocypris altidorsalis* Bianco and Banarescu,

1982; *Paracobitis rhadinaea* (Regan, 1906) and *P. vignai* Nalbant and Bianco, 1998 which are found in Sistan basin (Esmaeili et al. 2010).

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